

## Sources of community livelihoods and economic losses due to conflict with the sumatran tiger (*Panthera tigris sumatrae*) in the buffer area of Batang Gadis National Park

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### ABSTRACT

The existence of people living around the buffer zone in recent times has led to negative interactions in the form of conflicts between humans and wild animals, one of which is with the Sumatran tiger. The purpose of this study was to identify the sources of livelihood for the community in the buffer area of the Batang Gadis National Park (BGNP), and calculate the total economic losses suffered by the community due to human and wildlife conflicts in the buffer area of the national park. This study used a survey method, data were collected through interviews with selected respondents based on purposive sampling method with snowball technique. Data analysis is done by descriptive analysis. The results of the research show that the source of livelihood for the people living around the TNBG area is mostly farmers. The community's perception of the disturbance of wild animals and Sumatran tigers in Hutabaringin Julu Village and Bangkelang Village is that some people consider wild animals or Sumatran tigers to be beneficial to them in the balance of nature, and some others consider wild animals to be no useful in life because they are considered to disturb community plantation lands. The tiger conflict caused an economic loss of IDR 14,400,000 in Hutabaringin Julu Village and Bangkelang Village of IDR 35,280,000.

**Keyword:** Conflict, Sumatran Tiger, Sources of Livelihood, Economic Loss



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## 1. Introduction

Hutabaringin Julu Village and Bangkelang Village are located near the forest and directly adjacent to the Batang Gadis National Park Area. The forest is a habitat for various types of animals including the Sumatran tiger (*Panthera tigris sumatrae*), which allows animals to cross their range. So the interaction between tigers and the community often occurs. The distance between community lands that is quite close to forest areas tends to cause disturbances to wild animals coming out of the forest [1].

Many community activities around forest areas cause negative interactions between humans and wild animals, which result in conflict. In certain situations, conflict or interaction with wildlife can harm both parties. One of the adverse incidents of conflict and interaction between humans and tigers occurred in Bangkelang Village in 2018, causing the death of a Sumatran tiger. Negative interactions between humans and wild animals can have a negative impact on human life, in terms of social, economic, cultural, wildlife conservation, and the environment [2].

One of the biggest threats to the sustainability of the Sumatran tiger is human activity. Habitat destruction and fragmentation, illegal hunting and trade in tiger parts, as well as human-tiger conflict (HTC) are some of the factors causing the decline in Sumatran tiger populations [3-5]. The incident of HTC does not only occur due to limited feeding sources but also by human activities that limit their movement. The incidents of HTCs often cause both human and tiger victims [6].

The problem of HTC shows that tiger conservation is closely related to human livelihoods. Therefore, knowledge is needed about the factors that cause KMH and progress in reducing KMH. Comprehensive resolution is very important to reduce conflict between humans and tigers [7].

Research on people's sources of livelihood and their interactions with Sumatran tigers was carried out to obtain basic data regarding the forms of community dependence on nature and potential conflicts with animals. Previous research in the Batang Gadis National Park buffer zone related to conflict or community interaction with the Sumatran tiger was still very limited. The purpose of this study was to identify the sources of livelihood and calculate the total economic losses suffered by the people in the Batang Gadis National Park Buffer Area.

## 2. Method

### 2.1. Time and Place of Research

This research was conducted in the buffer zones of Batang Gadis National Park, namely Hutabaringin Julu Village (Puncak Sorik Merapi District) and Bangkelang Village (Batang Natal District), Mandailing Natal District, North Sumatra Province. Field research was carried out from April to May 2023. A map of the research locations can be seen in Figure 1.

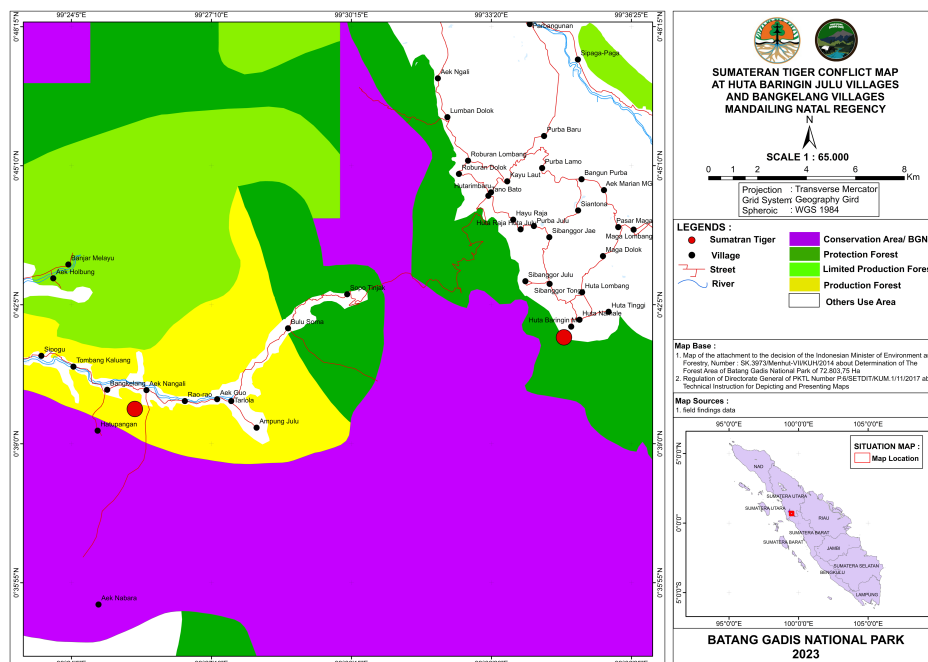


Figure 1. Research Locations

### 2.2. Collecting Data

Data collection was carried out using a purposive sampling method, referred to as an objective sample, which is sampling based on objectives not based on strata, coincidence or region [8]. The sampling technique uses the snowball technique, where the number of samples starts with a relatively small number before increasing. Similar to a snowball that gets bigger and bigger with time. Initial identification in snowball sampling begins with a person or case that meets the research criteria. Furthermore, the next respondent or the next sample unit can be found based on direct and indirect linkages in the network. The sampling process continues until sufficient information, an adequate and accurate number of samples is obtained for analysis, so that the research can be concluded [9].

The number of respondents who were sampled in Hutabaringin Julu Village was 29 people from the total number of heads of families, namely 151 heads of families. The number of respondents who were sampled in Bangkelang Village was 33 people from the total number of heads of families, namely 315 heads of families. Key respondents (key informants) were village heads and community leaders who were in conflict locations. Key respondents were taken by purposive sampling. 3 people in each village by holding discussions to find out the general condition of the research village. Furthermore, data processing is done by tabulating all data, then analyzed by descriptive and statistical analysis.

### 2.3. Data Analysis

#### 2.3.1. Analysis of community livelihoods

The data analysis carried out was descriptive analysis, which means describing or illustrating data collected through observation, interviews, questionnaires, and literature studies, without intending to make conclusions that can be accepted by many people [10].

#### 2.3.2. Economic loss analysis

The analysis is carried out by calculating the average economic loss caused by conflicts with wild animals that enter community cultivation by calculating the number of livestock preyed upon by wild animals and calculating the potential loss of community income due to conflict based on the type of work [11].

## 3. Result and Discussion

### 3.1. Source of Community Livelihood

Characteristics of respondents in this study include age, gender, occupation, religion, ethnicity, education, and population status. Respondents are villagers who experience the effects of conflict between humans and tigers. Analysis of the characteristics of the respondents is presented in Table 1.

Table 1. Characteristics of respondents

No	Characteristics	Hutabaringin Julu Village		Bangkelang Village	
		Frequency (F)	Percentage (%)	Frequency (F)	Percentage (%)
1	Age (Year)				
	a. < 15	0	0	0	0
	b. 15 – 65	28	97	24	73
	c. > 65	1	3	9	27
	Total	29	100	33	100
2	Gender				
	a. Male	26	90	24	73
	b. Female	3	10	9	27
	Total	29	100	33	100
3	Occupation				
	a. Officer	0	0	0	0
	b. Entrepreneur	2	7	1	3
	c. Trader and farmer	4	14	4	12
	d. Farmer	23	79	28	85
	Total	29	100	33	100
4	Religion				
	a. Moslem	29	100	33	100
	b. Christian	0	0	0	0
	Total	29	100	33	100
5	Tribe				
	a. Mandailing	28	97	33	100
	b. Java	1	3	0	0
	c. Batak	0	0	0	0
	d. Minang	0	0	0	0
	Total	29	100	33	100
6	Education				
	a. Elementary School	8	28	8	24
	b. Junior High School	13	45	11	33
	c. Senior High School	6	21	13	39
	d. University	2	7	1	3
	Total	29	100	33	100
7	Residence status				
	a. Native inhabitants	28	97	32	97
	b. Immigrant	1	3	1	3
	Total	29	100	33	100

Age characteristics in Hutabaringin Julu Village and Bangkelang Village, the highest percentage of respondents aged 15-65 years was 97% in Hutabaringin Julu Village and 73% in Bangkelang Village. This data shows that most of the respondents fall into the productive category of work. Productive age starts from 15 to 65 years so that they have better abilities in thinking and acting to plan activities [12]. In addition, for people who work productively there are expectations or demands in finding and cultivating a source of livelihood around wild animal habitats or around forests. Because indeed the area around the forest is the foundation for the community to survive.

Age > 65 years is included in the non-productive category (elderly), when compared between Hutabaringin Julu Village and Bangkelang Village, it can be seen in Table 1 that more non-productive age respondents are in Bangkelang Village (27%). The majority of the people in these two buffer villages work as farmers and some also work as traders. The large number of respondents with non-productive age in Bangkelang Village, because they feel they are still strong, and there are demands to work to earn income. This is according to the opinion of [13], that farmers continue to work in old age because they do not have insurance (pension) in old age, which means they have to keep working until they die. Farmer productivity in old age also occurs in several countries [14].

Respondents who came from Hutabaringin Julu Village 90% and Bangkelang Village 73% were mostly male respondents. This is because farmers with the male sex know more about the characteristics of the land they are cultivating and in terms of responsibility, men have a major role in exploiting the livelihoods of their families. Unlike the case with women who are the head of the family, they have to work in the fields, because they have responsibilities and are the foundation of life and their family members. This is in accordance with statement [15], that women in many developing countries rely on agriculture as their main source of life and is the main way to overcome poverty in their families.

Characteristics of ethnicity and religion, the two villages each have a number of respondents with a percentage of 100% being Muslim and having Mandailing ethnicity. According to [16], the people of Mandailing Natal are very religious, the traditions of Islamic life are seen to be strong in the community, plus customary norms that become role models. The Mandailing people admit that tigers will not disturb good people, and they believe that if a tiger enters the village, it means that someone has done something wrong or committed a sin in that village.

Judging from the level of education, it can be seen that respondents in Hutabaringin Julu Village were dominant 45% who had graduated from junior high school/equivalent. Meanwhile, in Bangkelang, the highest was 39% graduating from high school/equivalent. From these two villages, it is known that there are still many people who are not aware of the importance of getting an education. Stated [17] that farmers with higher education, both formal and non-formal, have a broader understanding of the importance of productivity.

Awareness of the importance of productivity plays an important role in encouraging efforts to increase agricultural production. Based on income, in Hutabaringin Julu Village, many people have an income of IDR 1,500,000 - IDR 2,500,000 per month (included in the medium category) about 48%, with an average working time of 8 hours per day (55%), namely working as rice, vegetable (chili, cabbage, celery), and sugar palm farmers, while the people in Bangkelang Village have an income of IDR 1,500,000 - IDR 2,500,000 per month (medium category) about 52%, with an average working time of 5 hours per day (91%) working as rice farmers and rubber farmers. The complete economic characteristics of the people in Hutabaringin Julu Village and Bangkelang Village can be seen in Table 2.

Table 2. Community economic characteristics

No	Characteristics	Hutabaringin Julu		Bangkelang	
		Frequency (F)	Percentage (%)	Frequency (F)	Percentage (%)
1	Income				
	a. < 1.5 mio	1	0	3	9
	b. 1.5 mio – 2.5 mio	14	48	17	52
	c. 2.5 mio – 3.5 mio	8	28	10	30
	d. > 3.5 mio	6	21	3	9
	Total	29	100	33	100
2	Land Ownership				
	a. Owner	28	97	30	91
	b. Rent	1	3	3	9
	Total	29	100%	33	100%
3	Large Area (ha)				
	a. 0	2	7	1	3
	b. < 0.25	1	3	1	3
	c. 0.25 – < 0.50	9	31	7	21
	d. 0.50 – < 0.75	10	34	13	39
	e. 0.75 – < 1.00	4	14	6	18
	f. 1.00 – < 2.00	3	10	5	15
	Total	29	100	33	100
4	Farm time				
	a. 0 hours	2	7	1	3
	b. 5 hours/ day	11	38	30	91
	c. 8 hours/ day	16	55	2	6
	Total	29	100	33	100

The land owned by these two villages is very fertile for farming, so that many people choose farming as a source of livelihood. In addition, they already understand the techniques of using the land because it has been passed down from generation to generation. Some respondents who do not own land or land will lease land to other farmers. The land is an important part of the life of people who depend on the agricultural sector. From the data, it can be seen that the area of land that is mostly managed by the people of Hutabaringin Julu Village 34% and 39% of Bangkelang Village is 0.50-0.75 ha.

Land has a role as an asset and commodity whose control status can change at any time. The socio-economic conditions of farmers will be affected by changes in land ownership because they will lose their right to own and control land. Agricultural land can be used as an indicator of the level of welfare, although it cannot fully reflect the actual level of welfare [18]. Based on community land ownership data, it can be seen in Figure 1.

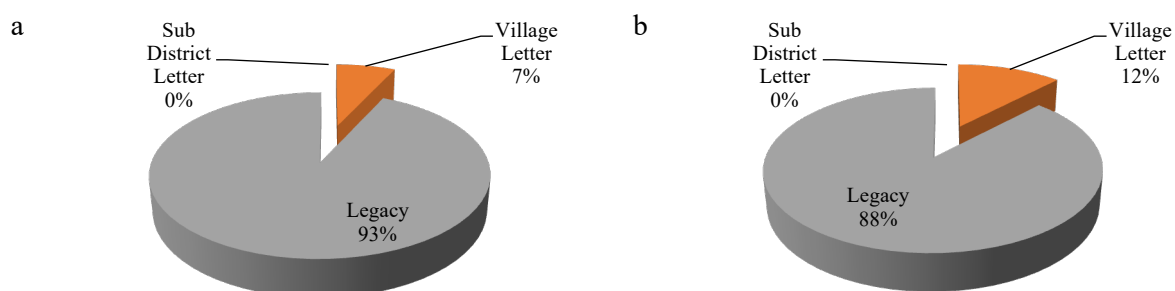


Figure 1. (a) evidence of land ownership in Hutabaringin Julu Village, (b) evidence of land ownership in Bangkelang Village

Interviews were conducted in Hutabaringin Julu Village and Bangkelang Village, there was no evidence of land ownership based on the District Head's Decree, while there were still few Village Decrees, both in Hutabaringin Julu Village and Bangkelang Village. Almost all respondents owned land based on inheritance passed down from generation to generation, 27 people (93%) in Hutabaringin Julu Village, and 29 people

(88%) in Bangkelang, according to the community land certificates were not that important. In addition, the management was also difficult and expensive. From the data obtained in the field, it is known that both in Hutabaringin Julu Village and in Bangkelang Village there has never been an agrarian conflict, there have been no overlapping land claims, there have been no conflicts between communities and communities. This condition is very beneficial in the management of buffer zones where the community is expected to be able to live side by side or be friends with wild animals because there is certainty in land management.

The types of plants found on community land in Hutabaringin Julu village are trees and non-trees, such as cinnamon (*Cinnamomum burmanii*), coffee (*Coffea* sp), sugar palm (*Arenga pinnata*), rice (*Oryza sativa*) and vegetables such as chilies, cabbage, celery. The land in this village can be planted with vegetables because the air is cooler than in other villages. Meanwhile, in the village of Bangkelang, the production of crops is in the form of rice and rubber (*Hevea brasiliensis*).

The people of Hutabaringin Julu Village and Bangkelang Village do not make much use of non-timber forest products and timber forest products. This is because community access to enter forest areas is quite difficult. It's just that at certain times, the community will use NTFPs, such as rattan for their agricultural purposes, as poles for chili plants. As for the type of wood, the community uses rubber trees and other trees as firewood.

### 3.2. Economic losses suffered by the community

The aftermath of the tiger conflict caused people to be afraid and unable to carry out their routines as usual. Potential loss of income, especially for farmers and farm laborers because they are afraid to go to the fields for harvesting or other activities. The loss of time experienced by the community is related to the number of people who experience trauma after the Sumatran tiger conflict. In Hutabaringin Julu Village, a conflict occurred in 2021, when tiger footprints were found around the community's fields.

The losses experienced were not material in nature, but there was concern when working in the fields. To anticipate this, people come later than usual and go home before evening. If people usually go to the fields at 07.00 WIB and return from the fields at 17.00 WIB, then after the conflict the people will go to the fields starting at 9.00 WIB and return sooner or around 15.00 WIB. This went on for 3-4 days so people experienced losses in the form of time. The assumption of economic loss is calculated with an average daily wage in the fields of IDR 80,000/day. The form of the economic loss of the Hutabaringin Julu community after the Sumatran tiger conflict in 2021 can be seen in Table 3.

Table 3. The economic loss of the Hutabaringin Julu farming community due to the conflict

Frequency	Work Hour	Income per day	Total (IDR)
Before conflict	8 hours/day	80,000	38,400,000
After conflict	5 hours/day	50,000	24,000,000
Loss		120,000/HH	14,400,000

\* Assuming for 4 days (120 HH)

The table above shows that after the Sumatran tiger conflict the community's working time decreased by 3 hours/day, directly proportional to the community's daily income or wages which decreased by IDR 30,000/day. The conflict in Hutabaringin Julu Village lasted 3-4 days, so the economic loss experienced by the community was IDR 120,000/household (HH). The conflict affected all farmers in Hutabaringin Julu Village, which if calculated based on a total of 150 HH, it was assumed that 80% of the 150 households worked as farmers, so the total economic loss experienced by the community was IDR 120,000 x 120 HH = IDR 14,400,000.

The conflict that occurred in Bangkelang, namely in 2022, is almost the same type of conflict as in Hutabaringin Julu Village, where Sumatran tiger footprints were found on community land. When there is conflict, the community cannot harvest and will lose their income, causing losses. The community suffers a loss for 2 weeks or 14 days because they are afraid to do activities in the fields, so the community suffers a loss in the form of time which is assumed to be an average daily wage of IDR 70,000/day. The following forms of economic losses for the people of Bangkelang after the Sumatran tiger conflict in 2022 can be seen in Table 4.

Table 4. The economic losses of the people of Bangkelang as a result of the conflict

Frequency	Work Hour	Income per day	Total (IDR)
Before conflict	5-6 hours/day	70,000	123,480,000
After conflict	4 hours/day	50,000	88,200,000
Loss		280,000/HH	35,280,000

\* Assuming for 14 days (126 KK)

The table above shows, after the Sumatran tiger conflict the community's working time decreased by 1-2 hours/day, directly proportional to the community's daily income or wages which decreased by IDR 20,000/day. The conflict in Bangkelang Village lasted 14 days, so the economic loss experienced by the community was IDR 280,000/head of family. The conflict affected some of the farmers in Bangkelang Village, because the location of the conflict was far from residential areas, besides that, the settlements of Bangkelang residents were not concentrated in one point. If it is calculated based on the number of heads of families who suffer losses, it is assumed that 40% of the 315 households, then the total economic loss experienced by the community for 14 days is IDR 280,000 x 126 households = IDR 35,280,000.

The value of the economic losses incurred after the Sumatran tiger conflict varied, depending on the length of the conflict. The longer the conflict occurs, the greater the losses incurred. According to [19], implementing a conflict victim compensation scheme can reduce the economic impact on farmers. This can increase the probability of coexistence. In addition to providing compensation, there must be an agreement and guarantee that the community will not expel or kill these animals if the plants are eaten or damaged by wild animals.

#### 4. Conclusion

The source of livelihood for the people living around the TNBG area, namely Hutabaringin Julu Village and Bangkelang Village, are farmers. The main commodities in Hutabaringin Julu Village are rice, sugar palm and various types of vegetables. Meanwhile, in Bangkelang Village, the commodities are rice and rubber. The total economic loss suffered by the people of Hutabaringin Julu Village for 3-4 days was IDR 14,400,000, and Bangkelang Village was IDR 35,280,000 with a conflict duration of 14 days. The longer the conflict occurs, the losses incurred will also be greater.

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